DOCUMENT RESUME

ED 045 296 RE 003 072

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TITLE	Grapheme-Phoneme Correspondence in Beginning Reading of Disadvantaged Five Year Olds.
INSTITUTION	George Peabody Coll. for Teachers, Nashville, Tenn. Demonstration and Research Center for Early Education.
SPONS AGENCY	Office of Economic Opportunity, Washington, D.C.: Office of Education (DHEW), Washington, D.C.
PUB DATE	70
CONTRACT	OEC-3-7-070706-3118
NOTE	31p.
EDRS PRICE	EDRS Price MF-$0.25 HC-$1.65
DESCRIPTORS	Basic Reading, *Beginning Reading, Culturally Disadvantaged, *Initial Teaching Alphabet, Preschool Education, *Reading Research, *Word Recognition

ABSTRACT

In order to determine the effect of grapheme-phoneme correspondence on beginning reading, word acquisition as related to the degree of regularity of the word was used as a measurement. Twenty children enrolled in a preschool project for culturally disadvantaged children at Peabody College were randomly assigned to two groups. One group used the three preprimers of the Scott Foresman basal reading series printed in traditional orthography, and the experimental edition of the same series printed in the Initial Teaching Alphabet was used for the other group. In all other ways the books and procedures were alike. A criterion test of 40 words was individually administered to each subject at the end of the instructional phase of the procedure and analyzed in a Winer Three-Factor Experiment with Repeated Measures design. Results of these tests revealed that the type of orthography used in instruction had no significant effect on the child's ability to recognize words. A bibliography is included. (DH)

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Volume 4, Number 2, 1970 DARCEE Papers and Reports

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RE 003 072

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ED0 45296

GRAPHEME-PHONEME CORRESPONDENCE IN BEGINNING READING OF DISADVANTAGED FIVE YEAR OLDS[1]

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[1]This report is based on parts of a dissertation submitted to the faculty of George Peabody College for Teachers in partial fulfillment of the requirements for the Ph.D. degree. This study was supported by the U. S. Department of Health, Education, and Welfare, Office of Education, Contract No. OEC-3-7-070706-3118, and by the Office of Economic Opportunity, Grant No. CG 9174 and CG 9995. Support was made possible through the Demonstration and Research Center for Early Education.

Introduction

One of the basic assumptions upon which several approaches to beginning reading have been predicated is that children have difficulty which is attributable to the lack of correspondence between the spoken phoneme and the written grapheme in the traditional English orthography. In the case of the culturally disadvantaged whose language patterns and speech sounds are so different from those typically used in the classroom, this poor match between sound and symbol may be a key to the high incidence of reading failure among these groups. The high incidence of reading failure among the culturally disadvantaged often leads to early school drop-out, a crucial social problem.

Research and theory from five areas contribute to the background literature upon which the present study was based: (1) studies of basic perceptual processes underlying reading, (2) studies of grapheme-phoneme correspondence per se, (3) methods designed to control grapheme-phoneme correspondence, (4) the relationship of reading to chronological age, and (5) the process of reading as it occurs in culturally disadvantaged or different groups. Several excellent reviews of the reading research literature are available elsewhere (Harris, 1963; Harris, 1965; Robinson, et al., 1966; Chall, 1967).

In the area of basic perceptual processes underlying reading perhaps the most notable work is that of Gibson (1962, 1964, 1966) who believes

that children perceive neither individual letters nor whole words but, rather, groups or clusters of letters based on grapheme-phoneme correspondences. Gibson calls these clusters "higher order invariants." In one experiment Gibson (1962) generated two lists of words, one according to rules of pronouncability and the second of unpronouncable words. The results of this experiment demonstrated that a letter-group with a high spelling-to-sound correlation is produced more accurately than an equivalent letter-group with a low spelling-to-sound correlation. Gibson pointed out that this result could not be caused by a difference in the familiarity of the letters taken alone, or even in the vowel and consonant clusters taken alone, for the same clusters were used in both lists. She concluded that the higher accuracy of production of the high pronouncable list must be due to the existence of higher order graphic units or letter combinations of English writing that function as relatively stable units in grapheme-phoneme correspondences. Anisfeld (1964) criticized Gibson on the basis that she did not control for summed bi-gram and tri-gram frequency and said that high pronouncability, or high grapheme-phoneme correspondence, alone could not account for a high accuracy of production. Gibson later showed, however, that summed bi-gram and tri-gram frequency <u>was</u> controlled in that each item had its match and that the same letters were used in the matched item as well as the same length. Bishop (1964) further demonstrated that transfer of word recognition skills is higher with a group trained using single letters than a group trained using whole words and

considerably higher than a control group. The subjects in this experiment were asked afterward to explain how they tried to learn the transfer words. Most of the letter-trained group reported using knowledge of component correspondences but so did 12 of 20 of the word-trained group. Bishop concluded that, although it is possible to learn words without learning the component letter-sound correspondences, transfer to new words depends on use of them, whatever the method of original training.

Richardson (1966) found no significant differences between three methods of teaching word recognition skills which involved continued concentrated emphasis on (1) letter similarities between words, (2) letter dissimilarities between words, and (3) a combination of similarities and dissimilarities. These findings elaborate those of Bishop somewhat and indicate that, although there is a differential learning rate between whole word trained groups and letter trained groups, there is none between specific letter trained groups.

Concurrently with the work in the Gibson laboratory, research in psycholinguistics has been aimed at analyzing the nature of grapheme-phoneme correspondence. Based on previous work (Moore, 1951; Venezky, 1966, 1967) Hanna et al. (1966) analyzed 17,000 words for grapheme-phoneme correspondence using an algorithm or set of rules for translating the spoken English phoneme to the written grapheme. A list of words was generated which were classified according to their degree of regularity or irregularity based on the number of spelling errors which occurred in their production.

The Hanna et al. work and that of Gibson et al. have represented two of the major efforts to delineate the nature of some of the variables involved in the process of reading itself before attempting to specify teaching methodology. Others, however, have felt that research on methodology should proceed concurrently with that of basic processes. Of the great number of methodological studies attempting to control grapheme-phoneme correspondence in beginning reading probably the best known are those of Downing (1962, 1966, 1967a, 1967b). He advocates the use of the Initial Teaching Alphabet (ITA) as a means of controlling the sound-to-symbol match. Although Downing has presented some very enthusiastic arguments supporting ITA, his conclusions have been sharply criticized on some rather basic points, such as experimental design and data analysis. The best statement at the present time seems to be that the efficacy of ITA has still not yet been fully determined. Research using ITA, as well as other orthorgraphies attempting to control grapheme-phoneme correspondence, has frequently shown rather serious deficits such as confounding of variables, use of inefficient designs, inappropriate statistical analysis and other research problems so that these results are at best confusing and at worst worthless or contradictory.

Another problem in the methodology of teaching reading concerns the optimal age for beginning reading. Many standard reading programs are based on the premise that a child must have attained a mental age of six and one-half years before he can be successful at reading but

no adequate research findings support this premise. A growing body of literature in this area (Moore, 1968, in press; Williams, 1965; Durkin, 1961, 1963; Muehl, 1962; Hendrickson & Muehl, 1962) suggests that a child might more profitably begin his reading experiences as early as two years of age. Furthermore, age interacts with the basic perceptual processes underlying reading so that age alone does not constitute an adequate predictor of reading success. Certainly the literature on cultural and perceptual deprivation confirm the deliterious effects of prolonged lack of stimulation and training in these areas.

Chall (1967) summarized the literature concerning reading programs for culturally deprived children and concluded that the evidence did argue for a different approach with these children. She espoused a code approach, which presents reading as a problem solving situation in translating the spoken language into written form and emphasizes early independence in recognizing words, as opposed to a meaning approach which stresses content rather than process. These conclusions were supported by numerous studies cited in her excellent review.

In summary, a review of the literature seemed to suggest the following cogent points:

1. There is a clear-cut need to study the basic processes underlying reading as a pre-requisite to attempting conclusions about effective reading methodologies.

2. It becomes increasingly clear that training in the basic perceptual processes associated with reading should begin as soon as possible.

Early training in these areas becomes crucial with the culturally disadvantaged.

3. The relationship of the spoken phoneme to the written grapheme is thought to play a significant role in these basic processes.

4. Because of their very different language and sound pattern backgrounds, the reading of culturally disadvantaged pupils is particularly affected by grapheme-phoneme correspondence.

Purpose

The purpose of this investigation was to study the effect of two different levels of grapheme-phoneme correspondence on word acquisition in beginning readers as related to the degree of regularity of the word. In order to assess the effect of grapheme-phoneme correspondence on beginning reading, groups of disadvantaged readers were taught by two methods: one using standard English orthography, where the grapheme-phoneme problem occurs, and one designed to create a better match between sound and symbol. Following instruction word recognition was related to level of word regularity in such a way as to permit assessment of the effect of instruction where the degree of grapheme-phoneme correspondence was varied systematically. Children's ability to generalize word acquisition skills to unfamiliar words as a function of degree of grapheme-phoneme correspondence was also measured.

Hypotheses Tested

Hypothesis I. Mean number of words acquired by subjects taught using a controlled grapheme-phoneme correspondence orthography will be greater than that of subjects taught using a non-controlled grapheme-phoneme correspondence orthography.

Hypothesis II. A. Word acquisition will decrease as level of irregularity increases.

Hypothesis II. B. For a controlled grapheme-phoneme correspondence orthography the decrease in word acquisition as level of irregularity increases will be less than for a non-controlled grapheme-phoneme correspondence orthography.

Hypothesis III. A. A controlled grapheme-phoneme correspondence orthography will result in a significantly greater acquisition of unfamiliar words than a non-controlled grapheme-phoneme correspondence orthography.

Hypothesis III. B. The acquisition of unfamiliar words will be significantly greater at higher levels of irregularity for a controlled than a non-controlled grapheme-phoneme correspondence orthography.

Method

Subjects

The subjects for this study were 20 children enrolled in a pre-school project for culturally disadvantaged children at Peabody College at the Demonstration and Research Center for Early Education (DARCEE). Of these children, who had been in the project for approximately nine months, half were Negro and half white, half were male and half female. All of the children in the Center participated in the experiment. The average age of the subjects was 73.25 months with a range of 70 months to 80 months while the mean IQ for the group was 106.05 with individual scores ranging from 78 to 134 as measured by a Stanford Binet, Form L-M given in July, 1968. The subjects were selected for admission to the pre-school program originally on the basis of several criteria of cultural deprivation

as well as ethnic group, sex, and geographic area. The Headstart financial guidelines using an annual income by number of family members formula published by the Office of Economic Opportunity were used as a standard for judging economic deprivation and 95 per cent of the families of the children in the pre-school fell within these limits (Office of Economic Opportunity, 1967). The mean annual income for the group was $3,375.20 with a range of $1,560 to $6,240. Mean number of members per family was 6.75 with a range of 2 to 16. If a child seemed to have specific needs but did not fall within the criteria of economic deprivation, other types of deprivation were considered such as cultural, experiential, motivational, sensory, etc. and 5 per cent of the families of the children fell within this category. A third criterion for judging eligibility for admission to the pre-school was that the child's home be within a reasonable distance of the campus where the pre-school was located so that his transportation time to the school did not exceed three-fourths of an hour.

These subjects had been presented an extensive reading readiness program throughout their pre-school experiences but had not as yet been introduced to formal reading activities.

Two groups of 10 subjects each were constituted from the alphabetical list of pre-school children using the table of random numbers.

Experimental Materials

Textbooks. The three pre-primers of the standard basal reading series published by the Scott Foresman Company (Robinson, et al., 1965a,

1965b, 1965c, 1965d, 1965e, 1965f) were used as textbooks for the experiment. The texts were presented in the standard order beginning with Now We Read and followed by Fun With the Family and Fun Wherever We Are. Both the regular standard edition, printed in traditional orthography (TO), and the experimental edition, printed in the Initial Teaching Alphabet (ITA), of each pre-primer were used. The books were exactly alike for both sets in type face and size, illustrations, and pagination except for the actual orthography used.

Word cards. A set of word cards was made by an artist for each orthography used containing one card for each new word presented in the textbooks. These cards were of two ply white Bristol board and measured 12 by 6 inches. The letters were centered on the card using black press-on type. Modern No. 20: 144 point (Stephenson Blake) type face was used, both capitals and lower case letters. A combination of capital letters, lower case letters, and hand lettering was used to make the special letters of the ITA set. Since ITA uses a larger lower case letter for capitals, 196 point lower case letters of the same type face was used. When the words had been printed on the cards, each card was then covered with transparent contact paper. The cards containing the unfamiliar words to be used in the criterion test were also made by this same procedure.

Criterion Measure

Examiner. The examiner was a white female graduate student in psychology who was not associated with the study and who was deliberately

kept uninformed concerning the study. She was unaware of the subjects' assignment to treatment groups.

Pre-test. In order to check on the equality of the two groups following random assignment, each subject in both groups was individually tested to determine the extent of his sight vocabulary relative to the words to be used in the instructional phase of the experiment. Each child was shown all of the words which would be used in the actual experimental procedure and asked to identify them. The words were presented in the order in which they were introduced in the texts and in which they would be presented during the instructional phase. The instructions were standard for each child and the words which the child correctly identified were then recorded by the examiner on a record form. Only one word was recognized by one child and that was the single letter word, I.

Criterion test. On the two days immediately following the termination of the instructional phase of the experimental procedure, a criterion test consisting of 40 words was individually administered to each subject. Half of these words were familiar words randomly selected from those introduced during the experimental period. Ten of these represented no error or high grapheme-phoneme correspondence words while 10 were categorized as one error words according to the Hanna (1966) data. The other half of the criterion list was made up of unfamiliar words matched to the familiar words on the basis of frequency of occurrence in the English language and level of regularity. Frequency was based on two factors:

(1) occurrence in the pre-primers of at least one other basal reading series and (2) Lorge-Thorndike norms (1963). Level of regularity was again taken as the error listing according to Hanna. In both familiar and unfamiliar sets of words the child was first asked to identify each of the words. He was then given an opportunity to simply recognize the correct word in a small group of word cards. Each word the child correctly identified or correctly recognized was then recorded by the examiner on a record form. Only the identification data are presented in the analysis section. The recognition data were not dissimilar from those obtained on identification and are not presented.

Experimental Procedure

Experimenter. The experimenter was a white female graduate student in school psychology. Both the adaptation period and the instructional phases were adminstered by the experimenter.

Adaptation period. In order to establish rapport between the experimenter and the subjects in a large group situation and to elicit attention to the instructional procedure and materials, two adaptation sessions were held. Each experimental group met with the experimenter for approximately 25 minutes each morning on an alternating schedule and participated in activites designed to be similar to the activities which were to be presented in the actual study but not identical. Picture cards containing black and white figures were used which were of approximately the same size as the word cards to be used in the instructional phase. Stories

were read to the children from a simple storybook rather than having the children use books themselves. At the end of two days adaptation, both groups were judged to be ready to begin the actual experimental program. Judgment of this readiness to begin was based on the facts that the children seemed to be attending well to the stimuli, they seemed well motivated toward reading type activities, participation was good and a good rapport was judged to have been established between the experimenter and the children.

Instructional procedures. The experimental procedure consisted of one lesson each day for 16 days for each group. On days 1 through 8 and days 10 through 14 the format of the session took the following form:

Part A. Word Acquisition Phase. During the initial period of each lesson a number of individual words were presented to the group using a modification of the Mills Learning Methods Test, Combined Method (1964). Two modifications were made in this combined method: (1) the kinesthetic procedures were deleted and only the combined auditory and visual techniques were used and (2) only word cards were used, not pictures. The number of words varied each day as a function of the number of pages to be covered in the practice phase which followed the word acquisition phase. The list of new words presented each day included all new words which would be introduced that day during the practice phase. The number of new words introduced in any one session varied to a maximum of nine. Each word was presented for approximately one and one-half minutes.

Part B. Practice Phase. During the second period of the reading lesson for the day the group read from the Scott Foresman basal textbooks (Robinson, et al., 1965) the three pre-primers which were presented successively, beginning with Now We Read and followed by Fun With the Family and Fun Wherever We Are. Each group covered approximately 12 pages in the text each day during the practice phase following a planned schedule. The "guiding interpretation" portion of the teacher's manual for each text was used in a programmatic fashion to present the material to the subjects. The groups were counterbalanced as to time of presentation of lesson each day in order to control for practice effects, fatigue and error on the part of the experimenter. The order of the groups was randomly assigned. A monitor was employed to check on the consistency of the program as carried out by the experimenter across both groups. The director of the Center in which the study was conducted served as the monitor. The monitored days were unscheduled so that the experimenter did not know which days were monitored and which were not until the end of the session for that day. On monitored days the monitor went over the sessions with the experimenter to note any differences between groups and specific plans were made for eliminating these as nearly as possible in future sessions.

The children in the DARCEE pre-school project are taught using a diagnostic teaching approach with programing for success experiences on the part of the children which are then reinforced according to a

definite pattern. The children are usually programed for either complete success or for just manageable difficulty. There is a constant evaluation and the program is shifted immediately if this level is exceeded. The programming at DARCEE involves a very complex and intricate analysis and execution of three general steps: (1) analysis of the child's potential ability as well as current level of functioning in the area(s) under consideration, (2) complete and detailed standard setting of the behavior and/or performance required, and (3) specific and consistent sets of reinforcements and schedules of reinforcement moving from concrete (food bits, chips, etc.) to social (hugs, pats, verbal praise, smiles, etc.) to intrinsic types as the program progresses during the year. A very good description of the rationale behind this type of programing is to be found in Gray et al., 1966. It became apparent quite early in the experimental study that the program which was being presented to the child was more difficult than those being presented in the regular classroom. The ceiling of the experimental tasks was considerably above even the brightest of the children. Consequently, although the children were felt to be well motivated toward learning in general and reading in particular, behavior control soon became a problem. Behavior control was reinstated by putting the children on reinforcement procedures and schedules similar to those used in their regular classroom. The children were reinforced for all attending behaviors and for responses as required by the instructional procedures such as oral reading, participation in discussion and answering questions.

On days 9 and 15 the format of the reading lesson varied somewhat. There were no new words to be introduced on either of these days. On day 9 the second pre-primer was concluded and on day 15 the third pre-primer was finished. On each of these days the practice phase was presented first. During the second portion of the reading lesson on each of these days a review was presented which consisted of showing the children all of the words which had been presented to that point on day 9 and all of the words which were presented from day 10 through 14 on day 15. These words were presented flash-card fashion by simply holding up the word cards one at a time and asking the children to identify the word. The words were shown to the subjects twice in the order in which they had been presented during the instructional phase. On these days the children were put back on primary reinforcement at 100 per cent schedule in order to increase motivation and attention. For each word the child correctly identified he was given an M & M, the same reinforcement used initially in his regular pre-school program.

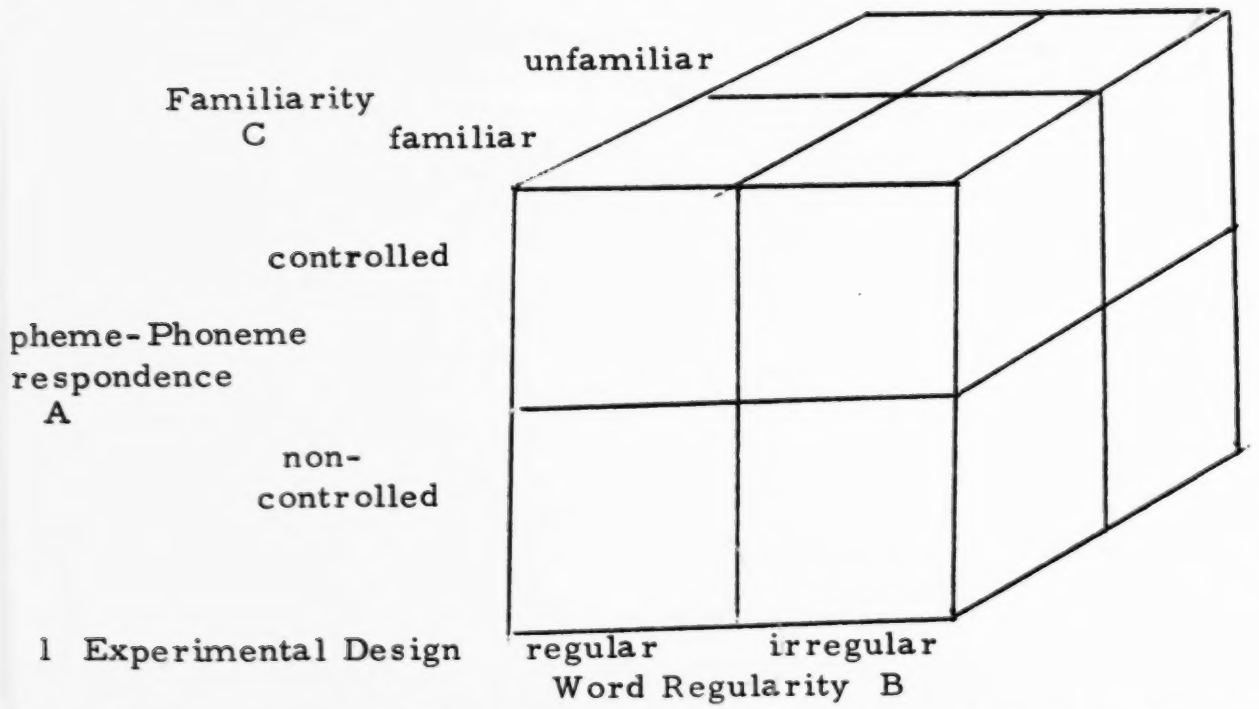
On day 16 each group was given a total review of all the words which had been presented during the experimental period. The format of this review followed that of the two previous partial reviews except that the reinforcement was changed. On this day for each correct response a child earned a chip which could then be traded in for a number of things of the child's choosing.

If a child were absent for one or two consecutive days during the experimental program, he was given the word acquisition phase individually

on the day of his return to school. One day absences occurred in 11 cases and two day absences occurred in three cases. If a child were absent for more than two days, the experimenter adminstered the word acquisition procedures to the child in his home at two-day intervals. This occurred in only two cases and these children were absent for three and four days respectively.

Results

The criterion test raw scores were analyzed in a Winer (1962) Three-Factor Experiment with Repeated Measures (Case I) design as illustrated in Figure 1. The A dimension represented the experimental treatment groups with one group being taught using a non-controlled grapheme-phoneme correspondence orthography, standard English, and the other group taught using a controlled grapheme-phoneme correspondence orthography, ITA. This dimension yielded a between subjects comparison. The B dimension, degree of word regularity, and the C dimension, level of word familiarity, were the two factors in which repetitions of subjects were used and these were within subjects comparisons as were all the



1 Experimental Design

interactions with these factors. The results of this analysis are shown in Table 1.

Table 1

Results of Analysis of Variance of Winer Case I Design

Source of Variation	df	x^2	s^2	F	F.95
Between Ss	19	18.74			
Orthography (A)	1	.61	.61	.60	4.41
SwG	18	18.13	1.01		
Within Ss	60	29.25			
Regularity (B)	1	1.01	1.01	5.32*	4.41
AB	1	.32	.32	1.68	4.41
BxSwG	18	3.42	.19		
Familiarity (C)	1	9.11	9.11	14.24*	4.41
AC	1	.02	.02	.03	4.41
CxSwG	18	11.62	.64		
BC	1	.12	.12	.60	4.41
ABC	1	.10	.10	.50	4.41
BCxSwG	18	3.53	.20		
Total	79	47.99			

*Significant at the .05 level.

The predicted differences between groups based on the orthography used in instruction were not obtained. Interactions between orthography used and the other two factors, degree of regularity of word and level of familiarity of word also failed to reach acceptable levels of significance.

A significant difference was found in subjects' ability to identify words based on their degree of regularity as demonstrated by the significant B main effect but it was in the opposite direction from that predicted. Inspection of the raw data indicated that the subjects were able to identify more irregular words than regular ones. The hypothesized interaction between degree of word regularity and orthography used in instruction moved toward significance but the prediction was not confirmed.

Analysis of the C dimension showed that the subjects were able to identify significantly more familiar words than unfamiliar ones. The predicted interaction between orthography used and level of words familiarity was not confirmed.

The second order interaction which had been predicted also failed to be confirmed. No reliable interrelationships were obtained between or among the three variables.

Discussion

The general concern of this study was the effect of grapheme-phoneme correspondence on beginning reading as measured by word acquisition. One of the major questions being asked was whether or not orthography used in instruction has a significant effect on a child's ability

to identify words. No differences were found between groups instructed in standard English orthography, where the grapheme-phoneme problem occurs, and in ITA, where some attempt is made to create a better match between sound and symbol. On the basis of these data it can only be concluded that the degree of match between sound and symbol does not affect a child's acquisition of word identification skills.

Several plausible explanations could be proposed for this finding of no differences between experimental treatment groups on several dimensions. One obvious interpretation of this finding may be that there are no differences in word acquisition as a function of orthography used in instruction. This would suggest that grapheme-phoneme correspondence does not have the significant effect which it is thought to have upon the learning of words. Two other findings occurred which seem to lend support to this interpretation.

The data showing a difference in subjects' ability to identify words based on their degree of irregularity are a very interesting, if somewhat surprising, finding. Not only did children recognize more irregular words that regular ones but this effect was the same across both groups. These data indicate that type of orthography used in instruction did not have a differential effect on degree of regularity of words recognized. If orthography is a major import, a differential group effect should have been obtained. No such effect having been obtained, further support accrues to the argument that the correspondence between grapheme and

phoneme may not be as crucial in beginning reading as generally presumed. These data may also initially seem to stand somewhat in contradiction to Chall's notion that the child's first task is to break the alphabetic code. If such is the case regular words would presumably be learned before more irregular ones. It may be, however, as will be argued later, that the subjects were measured during what is actually a prior stage in the development of beginning reading skills.

Secondly, although there was a significant difference in word recognition as a function of level of familiarity, confirming the seemingly self-evident fact that children who are just beginning their reading experiences are able to correctly identify more familiar words than unfamiliar ones, there was no interaction between type of orthography used in instruction and level of familiarity. Furthermore, there was no interaction between degree of regularity and level of familiarity in the presence of significant main effects of both these dimensions. This indicates that these main effects are the same across both groups and suggests, again, no differences as a function of type of orthography used.

When these findings are taken together, the evidence becomes more convincing that there are no differences in word recognition as a function of type of orthography used in instruction. This lack of difference occurs not only between the groups themselves but also between groups in interaction with other variables, even when these variables themselves are significant. These findings might be interpreted as indicating that

there was an equal amount of generalization in the two groups. There were other factors, however, which may militate against such an interpretation.

A second intrepretation which must be considered in the finding of no differences between groups as a function of the orthography used in instruction is that the ITA does not represent an actual one-to-one match between sound and symbol. These criticisms have been pointed out elsewhere (Griffin, 1967). While ITA does regularize the spelling of all irregular words in an attempt to control the correspondence between the spoken phoneme and the written grapheme the correlation between the two in this orthography is not perfect. From this standpoint, then, the standard ITA, as it was used in this study could not be said to represent complete control of the grapheme-phoneme correspondence variable. Further research using some completely controlled orthography would be necessary in order to fully explore this possibility.

Methodological considerations must also be examined in attempting to interpret the finding of no differences between experimental groups. It became apparent as the study progressed that two factors were operating which had not been anticipated. One of these concerned the program itself. As has been previously mentioned, it is believed that the level of difficulty of the program was above that which could be handled successfully by many of the children. The number of new words on some days and the number of pages covered per day in the texts seemed to be beyond the scope of assimilating or accommodating ability of some children

in both groups. Although an adequate ceiling was sought for the program in order to help promote reliability and validity of measurement, it is felt that an adequate floor was not developed. In addition, the total treatment time may have further minimized any differences which might have appeared as a function of difference in groups.

A second methodological factor which may have had an effect upon the experimental results is instructional variability. Although every effort was made to make the experimental procedure exactly the same across both groups, it is recognized that some differences did occur. The quantification of these differences is, at the present state of psychological knowledge and measurement, impossible. It is, therefore, not known to what extent level of difficulty of the program and instructional variability affected the results.

In view of instructional variability, inadequate program floor and lack of complete control of the grapheme-phoneme correspondence variable, the study hypotheses may not have received an adequate test. Further research is needed in order to establish whether the finding of no differences is a reliable one.

The data showing a difference in subjects' ability to identify words based on their degree of irregularity were very interesting and deserve a closer look as they may shed some light on interpretation of the present findings as well as a possible model underlying beginning reading. Gibson (1962) suggests that children learn words not as words or as groups of single letters but in intermediate units or clusters of letters. This implies, as a first step,

perceptual discrimination in terms of distinctiveness of cues. Gibson goes on to propose that the child learns to associate the written grapheme with the spoken phoneme according to some higher order invariant rules. It may be that the subjects in the present study at the time of the criterion testing had reached the stage of perceiving differences in the words in terms of distinct cues but had not as yet begun to associate symbol with sound. If a model of developmental stages of word recognition skills is appropriate and if the subjects were measured during this stage, the current results would obtain.

It is also interesting to note in scanning the raw data, that many of the children who showed higher irregular word identification scores than regular consistently identified correctly the word to. Although it was not in the criterion test, the word two was also in the list of words which the subjects learned. Of course, in ITA both words are written the same way so that the ITA subjects had additional practice in this word and the data may represent an artifact of the word list.

In summary, no differences were found in beginning reading as measured by the acquisition of word identification skills as a function of orthography used in instruction. On the basis of these data it can only be concluded that the degree of match between sound and symbol does not significantly affect a child's beginning reading skill. A consistent lack of differential effect between groups across all other dimensions also lends support to this interpretation.

Assuming the validity of the findings, the results were explained in terms of stages of development of word recognition skills. It was proposed that a stage of discrimination on the basis of distinctiveness of cues occurs prior to the actual association of the written grapheme to the spoken phoneme. If this model is appropriate the fact that differences were obtained in the acquisition of regular and irregular words would lend some support to the notion that the subjects may have been measured during this initial perceptual learning stage rather than at the later association stage.

Lack of complete control of the grapheme-phoneme correspondence variable and methodological considerations such as instructional variability and level of program difficulty may have militated against an adequate test of the hypotheses, however. The possibility that some of the current results may have been obtained as a function of an artifact of the word list used was also pointed out and discussed. Further research is needed in order to elaborate the nature of the effect of grapheme-phoneme correspondence upon beginning reading.

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